

WHAT IS CLAIMED IS:

1. A liquid crystal display, which comprises:

a lower substrate having a reflective electrode; a
5 lower alignment film formed on the lower substrate; an upper
substrate having a color filter and disposed opposite to the
lower substrate; an upper alignment film formed on the upper
substrate; a liquid crystal layer sandwiched between the
lower and upper substrates; a phase compensation film
10 adhered on the outer surface of the upper substrate and
serving to convert linearly polarized light into circularly
polarized light; and a polarizer adhered on the phase
compensation film and serving to convert natural light from
the external into linearly polarized light;

15 wherein the lower alignment film has an alignment
angle of -10 to 20° with respect to a horizontal line;

the upper alignment film has an alignment angle of 40
to 55° with respect to a horizontal line;

the liquid crystal layer has a phase delay value ($d\Delta n$)
20 of $0.24-0.27 \mu\text{m}$;

the phase compensation film has a phase compensation
function of $\lambda/4$ and also has an optical axis making an angle
of 140 to 146° with a horizontal line; and

the polarizer has a absorption axis making an angle of 120 to 122.5° with a horizontal line.

2. The liquid crystal display of Claim 1, wherein the liquid crystal layer is made of twisted nematic liquid
5 crystals having a twist angle of 60°.

3. A liquid crystal display, which comprises:

a lower substrate having a reflective electrode; a lower alignment film formed on the lower substrate; an upper
10 substrate having a color filter and disposed opposite to the lower substrate; an upper alignment film formed on the upper substrate; a liquid crystal layer sandwiched between the lower and upper substrates; a phase compensation film adhered on the outer surface of the upper substrate and
15 serving to convert linearly polarized light into circularly polarized light; and a polarizer adhered on the phase compensation film and serving to convert natural light from the external into linearly polarized light;

wherein the lower alignment film has an alignment
20 angle of 0 to 10° with respect to a horizontal line;

the upper alignment film has an alignment angle of 55 to 65° with respect to a horizontal line;

the liquid crystal layer has a phase delay value ($d\Delta n$)

of 0.23-0.27 μm ;

the phase compensation film has a phase compensation function of $\lambda/4$ and also has an optical axis making an angle of 160 to 168° with a horizontal line; and

5 the polarizer has a absorption axis making an angle of 117.5 to 127.5° with a horizontal line.

4. The liquid crystal display of Claim 3, wherein the liquid crystal layer is made of twisted nematic liquid
10 crystals having a twist angle of 76°.

5. A liquid crystal display which comprises:

a lower substrate having a reflective electrode; a lower alignment film formed on the lower substrate; an upper
15 substrate having a color filter and disposed opposite to the lower substrate; an upper alignment film formed on the upper substrate; a liquid crystal layer sandwiched between the lower and upper substrates; a phase compensation film adhered on the outer surface of the upper substrate and
20 serving to convert linearly polarized light into circularly polarized light; and a polarizer adhered on the phase compensation film and serving to convert natural light from the external into linearly polarized light;

wherein the lower alignment film has an alignment angle of 0 to 10° with respect to a horizontal line;

the upper alignment film has an alignment angle of 50 to 56° with respect to a horizontal line;

5 the liquid crystal layer has a phase delay value ($d\Delta n$) of 0.17-0.21 μm ;

the phase compensation film has a phase compensation function of $\lambda/4$ and also has an optical axis making an angle of 135 to 145° with a horizontal line; and

10 the polarizer has a absorption axis making an angle of 62 to 66° with a horizontal line.

6. The liquid crystal display of Claim 5, wherein the liquid crystal layer is made of twisted nematic liquid
15 crystals having a twist angle of 53°.

7. A liquid crystal display, which comprises:

a lower substrate having a reflective electrode; a lower alignment film formed on the lower substrate; an upper
20 substrate having a color filter and disposed opposite to the lower substrate; an upper alignment film formed on the upper substrate; a liquid crystal layer sandwiched between the lower and upper substrates; a phase compensation film

adhered on the outer surface of the upper substrate and serving to convert linearly polarized light into circularly polarized light; and a polarizer adhered on the phase compensation film and serving to convert natural light from the external into linearly polarized light;

wherein the lower alignment film has a pre-tilt angle selected from 80 to 90° and less than 2° or less and an alignment angle of -40 to -50° with respect to a horizontal line;

10 the upper alignment film has a pre-tilt angle selected from 2° or less and 80 to 90° in the opposite manner to the lower alignment film, and an alignment angle of 40 to 50° with respect to a horizontal line;

the liquid crystal layer is a HAN-mode liquid crystal layer serving to convert the phase of transmitted light depending on electric field application or no electric field application and has a phase delay value ($d\Delta n$) of 0.36-0.40 μm ;

the phase compensation film has a phase compensation function of $\lambda/4$ and also has an optical axis making an angle of 167 to 173° or 7 to 13° with a horizontal line; and

the polarizer has a transmission axis making an angle of 42 to 48° with a horizontal line.

8. The liquid crystal display of Claim 7, wherein the liquid crystal layer is made of twisted nematic liquid crystals having a twist angle of 90° .

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9. The liquid crystal display of Claim 7, wherein the phase compensation film has a phase compensation delay value of $0.14\text{--}0.15\ \mu\text{m}$.

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10. A liquid crystal display which comprises:

a lower substrate having a reflective electrode; a lower alignment film formed on the lower substrate; an upper substrate having a color filter and disposed opposite to the lower substrate; an upper alignment film formed on the upper
15 substrate; a liquid crystal layer sandwiched between the lower and upper substrates; a phase compensation film adhered on the outer surface of the upper substrate and serving to convert linearly polarized light into circularly polarized light; and a polarizer adhered on the phase
20 compensation film and serving to convert natural light from the external into linearly polarized light,

wherein a unit pixel of the liquid crystal display is divided into first and second regions;

a portion of the lower alignment film corresponding to

the first region is treated such that it vertically or horizontally aligns liquid crystal molecules in the first region, and a portion of the lower alignment region corresponding to the second region is treated such that it
5 horizontally or vertically aligns liquid crystal molecules in the second region in the opposite manner to the first region, the lower alignment film having an alignment angle of -40 to -50° with respect to a horizontal line;

a portion of the upper alignment film corresponding to
10 the first region is treated such that it vertically or horizontally aligns liquid crystal molecules in the first region in the opposite manner to the portion of the lower alignment film corresponding to the first region, and a portion of the upper alignment region corresponding to the
15 second region is treated such that it horizontally or vertically aligns liquid crystal molecules in the second region in the opposite manner to the first region, the upper alignment film having an alignment angle of 40 to 50° with respect to a horizontal line;

20 the liquid crystal layer is a HAN-mode liquid crystal layer serving to convert the phase of transmitted light depending on electric field application or no electric field application and has a phase delay value ($d\Delta n$) of 0.36 - 0.40

μm;

the phase compensation film has a phase compensation function of $\lambda/4$ and also has an optical axis making an angle of 167 to 173° with a horizontal line; and

5 the polarizer has a transmission axis making an angle of 42 to 48° with a horizontal line.

11. The liquid crystal display of Claim 10, wherein the lower alignment film and the upper alignment film have
10 different pre-tilt angles of 2° or less and 80 to 90°.

12. The liquid crystal display of Claim 11, wherein the liquid crystal layer is made of twisted nematic liquid crystals having a twist angle of 90°.

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13. The liquid crystal display of Claim 10, wherein the phase compensation film has a phase compensation delay value of 0.14-0.15 μm.

20 14. A liquid crystal display which comprises:

a lower substrate having a reflective electrode; a lower alignment film formed on the lower substrate; an upper substrate having a color filter and disposed opposite to the

lower substrate; an upper alignment film formed on the upper substrate; a liquid crystal layer sandwiched between the lower and upper substrates; a phase compensation film adhered on the outer surface of the upper substrate and
5 serving to convert linearly polarized light into circularly polarized light; and a polarizer adhered on the phase compensation film and serving to convert incident light into linearly polarized light,

wherein a unit pixel of the liquid crystal display is
10 divided into a transmission region and a reflection region having the reflective electrode;

a portion of the lower alignment film corresponding to the reflection region is treated such that it vertically or horizontally aligns liquid crystal molecules in the
15 reflection region, and a portion of the lower alignment region corresponding to the transmission region is treated such that it horizontally or vertically aligns liquid crystal molecules in the transmission region in the opposite manner to the reflection region, the lower alignment film
20 having an alignment angle of -40 to -50° with respect to a horizontal line;

a portion of the upper alignment film corresponding to the reflection region is treated such that it vertically or horizontally aligns liquid crystal molecules in the

reflection region in the opposite manner to the portion of the lower alignment film corresponding to the reflection region, and a portion of the upper alignment region corresponding to the transmission region is treated such that it horizontally or vertically aligns liquid crystal molecules in the transmission region in the opposite manner to the reflective region, the upper alignment film having an alignment angle of 40 to 50° with respect to a horizontal line;

a portion of the liquid crystal layer corresponding to the reflection region is made of a HAN-mode liquid crystal layer, and a portion of the liquid crystal region corresponding to the transmission region is made of a TN mode liquid crystal layer;

the phase compensation film has a phase compensation function of $\lambda/4$ and also has an optical axis making an angle of 167 to 173° with a horizontal line; and

the polarizer has a transmission axis making an angle of 42 to 48° with a horizontal line.

15. The liquid crystal display of Claim 14, wherein the lower alignment film and the upper alignment film have different pre-tilt angles of 2° or less and 80 to 90°.

16. The liquid crystal display of Claim 14, wherein
the HAN mode liquid crystal layer and the TN mode liquid
crystal layer are made of twisted nematic liquid crystals
5 having a twist angle of 90° .

17. The liquid crystal display of Claim 14, wherein
the HAN mode and TN mode liquid crystal layers have a phase
delay value ($d\Delta n$) of $0.36\text{--}0.40\ \mu\text{m}$.

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18. The liquid crystal display of Claim 14, wherein
the phase compensation film has a phase compensation delay
value of $0.14\text{--}0.15\ \mu\text{m}$.

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